

App. No. 10/848,742
Office Action Dated December 23, 2005

IN THE CLAIMS

Amendments To The Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Claim 1 has been amended.

Claims 3, 5, 12-17 and 61-63 are canceled without prejudice or disclaimer.

Listing of Claims:

1. (Currently Amended) A magneto-resistive element, comprising:
 - an intermediate layer; and
 - a pair of magnetic layers sandwiching the intermediate layer;
 - wherein one of the magnetic layers is a free magnetic layer in which magnetization rotation with respect to an external magnetic field is easier than in the other magnetic layer;
 - wherein the free magnetic layer is a multilayer film including at least one non-magnetic layer and magnetic layers sandwiching the non-magnetic layer;
 - an element area, which is defined by the area of the intermediate layer through which current flows perpendicular to the film plane, is not larger than $1000\mu\text{m}^2$; and
 - the non-magnetic layer has a thickness d in the range of $2.6\text{ nm} \leq d < 10\text{ nm}$;
 - wherein, when the magnetic layers m are the magnetic layers in the free magnetic layer that are arranged at positions m (with m being an integer of 1 or greater) from the intermediate layer, M_m is an average saturation magnetization of the magnetic layers m

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and d_m is their respective average layer thickness, then the sum of the products $M_m \times d_m$
for odd m is substantially equal to the sum of the products $M_m \times d_m$ for even m ; and
the non-magnetic layer is made at least one selected from the group consisting of
Ta, Ti, Zr, Hf, V, Nb, Cr, Mo, W, Al, SiO_2 , SiC, Si_3N_4 , Al_2O_3 , AlN, Cr_2O_3 , Cr_2N , TiO,
TiN, TiC, HfO_2 , HfN, HfC, Ta_2O_5 , TaN, TaC, BN and B_4C .

2. (Original) The magneto-resistive element according to claim 1, wherein an area of the free magnetic layer is larger than the element area.

3-38. (Canceled)

39. (Original) The magneto-resistive element according to claim 1, wherein the intermediate layer is made of an insulator or a semiconductor including at least one element selected from the group consisting of oxygen, nitrogen, carbon and boron.

40. (Canceled)

41. (Original) The magneto-resistive element according to claim 1,
wherein the intermediate layer is made of at least one metal selected from transition metals, or at least one conductive compound selected from compounds of transition metals with oxygen, nitrogen and boron; and
wherein the element area is not larger than $0.01 \mu m^2$.

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42. (Original) The magneto-resistive element according to claim 41, wherein at least one of the magnetic layers sandwiching the intermediate layer comprises a ferromagnetic material including oxygen, nitrogen or carbon, or an amorphous ferromagnetic material.

43-44. (Canceled)

45. (Original) The magneto-resistive element according to claim 1, wherein the free magnetic layer serves as a magnetic memory layer.

46. (Canceled)

47. (Original) The magneto-resistive element according to claim 1, further comprising a flux guide.

48. (Original) The magneto-resistive element according to claim 47, wherein at least a portion of the free magnetic layer serves as the flux guide.

49-50. (Canceled)

51. (Original) The magneto-resistive element according to claim 1, wherein, when "a" is the longest width of the element shape of the free magnetic layer, and "b" is its shortest width, then a/b is in the range of $1.5 < a/b < 10$.

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52-58. (Canceled)

Original

59. ~~(Withdrawn)~~ A data communication terminal equipped with a plurality of magneto-resistive elements according to claim 1, wherein data that have been communicated by electromagnetic waves are stored in the free magnetic layers of the magneto-resistive elements.

60-64. (Canceled)

65. (Previously Presented) The magneto-resistive element according to claim 1, comprising a pinned magnetic layer, an intermediate layer and a free magnetic layer, wherein the free magnetic layer is in contact with a buffer layer, wherein the buffer layer is made of a composition including a non-magnetic element, in which 10wt% to 50wt% of a non-magnetic element is also present in a magnetic layer in contact with the buffer layer, and wherein the saturation magnetization of said composition is not more than 0.2T.

66. (Previously Presented) The magneto-resistive element according to claim 65, wherein the non-magnetic element comprises at least one selected from the group consisting of Cr, Mo and W.

67 - 68. (Canceled)

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69. (Original) The magneto-resistive element according to claim 1, wherein the free magnetic layer is made of at least one non-magnetic layer and magnetic layers sandwiching the non-magnetic layer, and wherein a total film thickness of the magnetic layers is at least 4nm.

70. (Canceled)

71. (Original) The magneto-resistive element according to claim 1, wherein the non-magnetic layer comprises at least one compound selected from the group consisting of oxides, nitrides, carbides and borides.

72. (Original) The magneto-resistive element according to claim 71, wherein the non-magnetic layer is a multilayer film including at least one layer of non-magnetic metal and at least one layer of non-magnetic material selected from the group consisting of oxides; nitrides, carbides and borides.